MONTHLY WEATHER REVIEW,

DECEMBER, 1875.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

The present review of the atmospheric phenomena during December, 1875, is based upon, first, the tri-daily simultaneous observations charted at this office for the study and preparation of the weather predictions (the international simultaneous observations have not been used); second, the reports of monthly means and abstracts from 475 stations classified as Canadian, Naval Hospitals, Army Posts, Volunteer, Marine and United States Signal Service; third, such newspaper reports as seemed reliable.

The month of December has been, in general, marked by the following peculiarities:

First, the high barometric pressure, with infrequent and feeble storms in the United States.

Second, the high temperature, the average of the month being in the Ohio valley and Northwest, ten degrees above the normal. In the Southwest and Mississippi valley and westward to the Pacific, the month has been one of, if not the warmest on record.

Third, the large excess of rainfall in Oregon.

Fourth, almost total absence of auroras.

BAROMETRIC PRESSURE.

In general—The general distribution of atmospheric pressure during the month is shown by the isobars of Chart No. II. With scarcely an exception the average pressure for this month is from 0.15 to 0.20 inch below that for December, 1874, and somewhat below the mean for the past five years. The areas of low and high pressure have been neither numerousn or intense; the paths of the former have kept to the northward of their average route; the areas of high pressure have appeared to follow the Mississippi valley southward rather than southeastward until they reached the Gulf coast.

Areas of Low Barometer.—During the month eight important barometric minima have occurred at Portland, Or., six of which, those of the 1st, 3d, 18-19th, 24th, 27-28th and 31st, were of sufficient extent, or were central in such southern latitudes, as to produce sensible effects among our stations on the east side of the Rocky mountains. Several small and temporary minima seem to have originated during the month on the plains of the West and the Southwest. These were, however, the necessary results of the warm southerly winds blowing over these plains northward toward such regions of low barometer as passed from the Pacific coast into British America. Thus the storms west of the Mississippi have frequently been due to those occurring a few days earlier on the Pacific coast, and might, with some propriety, be traced backward to them; they have first appeared as long, narrow barometric depressions parallel to the mountain ranges; but, soon losing this feature, became more nearly circular as they passed eastward. Several minor depressions in the Northwest and the Southwest have been too local or evanescent, or too indefinite, to allow of a presentation of their tracks

on the accompanying Chart No. I. The month seems to have been exceptionally stormy on the North Atlantic, and the period of unusually numerous severe storms that seems to have prevailed in the Pacific during October and November has, we judge, extended into the month of December: on the 1st a typhoon passed northward over the island of Luzon, East Indies.

I. This small depression moved from the Texas coast on the afternoon of December 4th to the Ohio valley, where it joined No. II.

II. A very general depression west of the Mississippi lasted during the first four days of the month; it was followed on the fifth by cold northwest winds and rising barometer at the Rocky mountain stations. Of the extensive depression that formed to the eastward and extended from the Missouri valley to Virginia, one branch, that in the Indian Territory, appears to have moved northeastward and formed a nucleus for the rest. The gradients attending this low barometer were at no time steep, nor the wind severe, and in the course of its slow eastward progress the central depression gradually filled up until lost in New England on the 9th.

III. A similar ill-defined area of low barometer presented itself in the Northwest at the 11 P. M. report of the 9th. This remained on the northern limits of the weather charts, and was lost sight of in Canada on the 11th.

IV. The high pressure prevailing in Oregon from the 7th to the 11th may, to judge from the rainfall on the 11th, have been accompanied by a low barometer to the northward, and one that would explain the sudden appearance at the 4:35 p. m. report of indications of a storm then central in Manitoba. The violent winds and steep gradients of this depression enable its path to be given with corresponding accuracy, although almost entirely confined to the region north of our stations until the 13th, when it passed into New England, and was there lost sight of in the greater region of very low barometer that had prevailed on the East Atlantic and Newfoundland coasts since the 8th.

V. This depression appeared first in Manitoba under circumstances very similar to those attending the preceding one. The barometer fell decidedly at Bismarck, Pembina and Garry from 4 to 11 P. M., December 13th, and then very rapidly until 7 A. M., December 14th, at which time the centre of the depression may be placed approximately at latitude 51° and longitude 104½°; which, on the other hand, may also be said to be the position of the southern end of an elongated belt of low pressure, in case, as seems probable, this depression originated, as many others do, in such a belt at the base of the eastern slope of the Rocky mountains. The central pressure continued at 29.30, with increasing southwest winds on the Lakes, until the evening of the 15th, when it rose at the centre, and the disturbance was lost either in lower Canada or in New England.

VI. The southernmost portion of that remnant of No V, which appears on the map of 7:35 A. M., December 16th, was during that day evidently enclosed by the flow of air from British America and converted into a separate area, which gradually became better defined as it passed over Maine and the Gulf of St. Lawrence on the 17th and 18th.

VII. This slight depression originated in a manner similar to that of No. VI, and can only be traced from Lake Huron, on the 17th, 11 P. M., to northern New York, on the 18th, 11 P. M. Its track is too uncertain to justify presentation on Chart No. I.

VIII. The low barometer prevailing on the 18th on the Pacific coast, was on the 19th, followed by falling pressure in Manitoba, where it remained low until the 21st; on the morning of which day the depression was apparently central to the north of Lake Superior, where it remained until midnight of the 22d, and then disappeared before the

cold northwest winds, and without perceptibly running into the general depression prevailing over the regions to the eastward of New England. As in the case of the preceding area, the path of this storm-centre cannot be satisfactorily given on Chart No. I.

IX. The origin of this well-marked area of low barometer may, with some plausibility, be traced back to northern Mexico and the most southern portion of Texas, where, on the 19th, there prevailed southeast winds and threatening weather followed by northerly gales. This condition of affairs was due to the low barometer then prevailing from Texas to Manitoba and to Oregon, and the consequent high barometer over the Gulf and South Atlantic States. The area of rain extended slowly northward, reaching Indian Territory 4:35 P. M., December 22d, while cold northerly winds were beginning to prevail in Nebraska and Minnesota. By the afternoon of the 23d the pressure had fallen decidedly from Kansas to Texas, and the region of lowest barometer may be apparently placed as given on Chart No. I. Steep gradients and brisk winds prevailed over the Lakes on the 24th, but the storm passed rapidly northeastward on the 25th beyond our limits.

X. Following closely in the rear of No. IX we find No. X in Kansas at 11 P. M., December 25th. Its progress northeastward on the 26th was quite rapid, with steadily falling barometer and brisk winds on the Lakes. On the morning of the 27th the central depression was probably over the Gulf of St. Lawrence.

In connection with this disturbance there have been reported: At Owensville, Ind., at 3 P. M., on the 26th a very destructive gusty wind from the southwest lasting five minutes and having the force of a tornado; at Boston, at 9:30 P. M., a thunderstorm and electric phenomena.

XI. A notable barometric depression, with heavy rain and brisk southwest winds, prevailed in California and Oregon during the morning of the 28th; by midnight its influence was seen in the falling pressure throughout the whole region from the Mississippi valley to the Pacific, and apparently also in British America. From the trend of the isobars it may be concluded that the lowest pressure was at this time central east of British Columbia, and approximately in latitude 55° and longitude 110°. If, after 11 P. M., of the 28th, there were any well-defined area of low barometer, it must have remained far to the north and passed over Hudson's Bay; the limits of the present weather charts only show the V-shaped southern end of a remarkable extended area of low pressure, whose position may be defined by the following data, which give the approximate position of the east side of the visible portion of the isobar of 29.50.

The east side of isobar of 29.50 extends—

December 28th, 11 P. M.,	from longitude 95°	latitude 50°
	to " 98°	" 44°
December 29th, 7.35 A. M.,	from longitude 92°	latitude 48°
	to " 97°	" 40°
December 29th, 4.35 P. M.,	from longitude 87°	latitude 48°
	to " 96°	" 37½°
December 29th, 11 P. M.,	from longitude 87°	latitude 47½°
	to " 97°	" 39°

By this latter date the rising barometer on the Oregon coast had begun to affect the pressure in Dakota, but pressure continued low in southern California and thence to the West Gulf States; consequently the area of 29.50, just considered, retired to the northward, except a small portion which was cut off and isolated in the lower Missouri valley. During the remaining last two days of the month there remained between two areas of high barometer a belt of low pressure, strongly contrasted temperatures and cloud or rain, extending from Texas to Missouri and to the Lower Lakes, bordered on either side by

opposing north or northwest and south or southeast winds. On the 21st the steadily increasing rains in the southwest culminated in a well-marked storm that was central at midnight in western Arkansas, but whose history belongs properly to the following month of January.

It often happens that cold northeast winds on the Atlantic coast can be attributed to the flow of abnormally cold air from areas of high barometer over the St. Lawrence valley and Gulf; but, on the other hand, these winds have equally often a more direct dependence on the presence of a low barometer off the South Atlantic coast. In some cases the cold northern current evidently underruns the warmer air of the sea and thus initiates a storm; in other cases it seems probable that we must look to the advancing hurricane as the prime cause of the northeast winds, since, by its presence, it gives occasion for the southern flow of the colder air, precisely as a deficiency of pressure over the Mississippi valley and Gulf States makes room for the cold northers and high pressures that travel from Manitoba southward. The following instances of this class of storms have occurred during the month:

XII. The barometer rose with northeast winds on December 2d, both at the Bermuda and the South Atlantic stations, under the influence of a region of high pressure that was central at 11 p. m. in New York; by 7:35 a. m., of the 3d, the barometer had fallen slightly on the North Carolina coast, where marine reports show a destructive gale from the northeast and southeast in progress; at 4:35 p. m., the barometer had fallen at both Hatteras and Bermuda; a hurricane was reported in latitude 33°, longitude 73°, and the central depression was approximately in latitude 29°, longitude 76°; December 3d, 11 p. m., the centre is estimated to have been at latitude 32°, longitude 78°. Possibly, however, a long belt of pressure was now developed; for, by the morning of the 5th, the barometer had fallen on the North Carolina coast sufficiently to render it probable that the storm-centre was then east of Norfolk; and, at 11 p. m., it appears to have been midway between Capes Henry and May; at 7:35 a. m., of the 6th, a disturbance was evidently central east of New Jersey, and this may have been the remnant of the storm previously described. Equally possible is it that this was but one of several fragments into which the original storm became subdivided; for, at this same time, December 6th, 7:35 a. m., the pressure had, at the Bermudas, fallen to 29.76; at 4:35 p. m., it was at 29.50, and at 11 p. m., of the 6th, 29.54; showing that either several storms were in progress or that the isobar of 29.60 surrounded a much larger area, including Bermuda and Nova Scotia as its western boundary. The latter supposition is confirmed by the fact that the European weather maps of the 6th and 7th show that, at this time, an area of high pressure was rapidly descending over Ireland and Great Britain, so that at 8 a. m., Greenwich time, of the 7th, (about 3 a. m., Washington time,) the isobar 30.50 passed through northern Scotland with higher pressure to the northward and westward. For the three subsequent days the positions of the isobars over Ireland moved slowly southward, showing that the motion of the areas of high pressure was more to the southwest than to the southeast; we should therefore expect that the low pressure located east of the Bermudas moved northeastward past Nova Scotia and Newfoundland on the 7th and 8th toward Iceland on the 9th or 10th.

XIII. In intimate connection with the preceding disturbance there appears on the 7th, at 4.35 p. m., a storm-centre near Cape Hatteras. The reports of that time show—Cape Hatteras, barometer, 29.17; wind direction, north; velocity, 17 miles. Bermuda, barometer, 29.71; wind direction, south; velocity, 7 miles. This, like its predecessor, seems to have passed northeastward up the coast.

XIV. The reports of December 11th, 4:35 p. m., from the South Atlantic coast, suggested the possibility of there being, at that time, a small storm to the east of North

Carolina, a suspicion that was confirmed by the Bermuda and the marine reports, from which the following estimates of its position have been compiled:

December 11th, 11 P. M., latitude 30°, longitude 75°.
12th, 7 P. M., latitude 32°, longitude 75°.
12th, 4 P. M., latitude 34°, longitude 70°.
12th, 11 P. M., latitude 36°, longitude 65°.

On the morning of the 13th, the storm may have been central not far from latitude 44, longitude 61°; but, in the absence of further data, it cannot be decided whether two distinct areas or one elongated area of low pressure then existed.

NOTE.—The uncertainty of the positions given for the tracks of the three storms—XII, XIII and XIV—renders it improper to present them upon Chart I. They are, however, instructive as showing, on the one hand, how frequently a northeast wind at our Atlantic stations points to a storm-centre a few hundred miles eastward; and, on the other, what valuable knowledge, as to their existence and movements, we obtain by means of the reports from the Bermudas.

Areas of High Barometer.—These have, as a rule, either passed southward west of the Mississippi or passed eastward to Labrador and thence southward along the Atlantic States. The Ohio valley and Middle States have been singularly free from their presence. Testimony is afforded this month, as usual, to the conclusion that our cold areas are formed in consequence of radiation of heat through extremely dry air and that a layer of cold, dry and, therefore, dense air, by underrunning and uplifting warmer, moister air, gives rise first to an area of high pressure, and subsequently to condensation of vapor and the initiation of an area of low pressure.

I. Appears as an area of cold air flowing southward over Upper Canada; its centre passed as follows:

December 1, 7:35 A. M., Upper Canada;
" 2, 7:35 A. M., St. Lawrence valley;
" 3, 7:35 A. M., New England;
" 4, 7:35 A. M., Middle and Eastern States;
" 5, 7:35 A. M., St. Lawrence valley.

Cold northeast winds extended southward along the Atlantic coast, with fog, cloud and rain or snow, as far as North Carolina on the 4th.

II. Following in the rear of low barometer No. II we find the rising pressure culminating on the 7th, at 7:35 A. M., at the Pacific Coast stations, and on the 8th, at 7:35 A. M., in Manitoba and Dakota, where a temperature of —25° was reported. This high barometer rapidly spread out to the south and east and cannot be definitely traced; it evidently contributed its quota to the high pressure then beginning to extend over the Southern States and Ohio valley.

III. The rising barometer and low temperature on the 9th in Manitoba was, on the morning of the 10th, central in the Missouri valley, and flowing thence southward disappeared in the Southwest on the 11th. A remnant was apparently left at midnight in southern Texas, whence it, on the 12th, spread over the Gulf and Gulf States, while the barometer was abnormally low over the Lake region.

IV. On the afternoon of the 13th the rising barometer in the rear of low No. IV presented its culmination as a belt of high pressure extending over Arkansas and Missouri; December 13th, 11 p. m., this area extended from Mississippi to southeastern Dakota; December 14th, 7:35 a. m., it included Missouri, Louisiana and South Carolina; December 14th, 4:35 p. m., it included Mississippi and Louisiana; December 14th, 11 p. m., it extended from Louisiana to South Carolina and Florida; December 15th, 7:35 a. m., it extended over Mississippi, Georgia and Florida; December 15th, 4:35 p. m.,

it covered Florida, and became wholly identified with the Atlantic tropical belt of high pressure, of which it then formed the western end.

V. While high No. IV was, on the 15th, in Florida and low No. V was over the Lakes, the barometer rose in Oregon, Manitoba and Wyoming. The maximum pressure was attained in Manitoba by midnight of the 16th, by which time the cold air had, in its southern flow, reached the coasts of Texas as a "norther." On the morning of the 17th the area of high barometer was central in the lower Missouri valley, and by that afternoon had passed southeastward so as to cover Arkansas and Missouri, and by 11 p. m. it extended from Cairo to Vicksburg. On the 18th, 7:35 a. m., the highest pressure was in northern Mississippi and Alabama; by 4:35 p. m. it had apparently moved southeastward, by 11 p. m. it was in northwestern Florida, and on the 19th, 7:35 a. m., in southern Alabama and Georgia, after which it becomes indistinguishable from the general tropical area of high pressure over the Atlantic. The average rate of movement of the well-defined central highest pressure was thirty-one miles hourly from the 16th, 11 p. m., to the 18th, 11 p. m.; but the advancing edge of the outer portion of the area moved much more rapidly southward and eastward.

VI. This area of low temperature and high barometer appeared in Manitoba on the 18th; it moved eastward over the British Provinces and was central in Canada north of Lake Ontario at 4.35 p. m., December 19th; the temperature fell to –25° at Ottawa at 11 p. m., and continued below zero over New England on the morning of the 20th, being the lowest temperature of the month at most places in that district, and varying from 0 at the southern to –29° at the northern stations. The rapid flow southward over the Atlantic of the comparatively small area of cold air, and the developement in the west of low barometer No. VIII, allowed this cold period to change rapidly into one of comparative warmth; the central area of high pressure was lost sight of on the 21st as it reached the coast of South Carolina and Georgia and joined the already extended tropical area of high barometer.

VII. On the morning of the 23rd, the rapid barometric rise in Manitoba and cold north winds indicated there the southern edge of another area of high pressure, which, however, like its predecessor, kept well to the north of our stations until, in its eastward progress, it arrived at the St. Lawrence valley at 11 p. m., December 23. On the 24th, at 7:35 a. m., it covered the lower St. Lawrence and greater part of New England and New Brunswick. Its path continued eastward over Labrador and Newfoundland, until 7:35 a. m., December 25, when it was apparently central to the southeast of the Gulf of St. Lawrence; meanwhile, a large volume of air flowed southward along the coast as far as Cape Hatteras, producing, with the help of low No. IX, continued northeast winds, cloud, rain, snow or fog during the 24th.

VIII. On the 26th, the rising pressure to the northward of low No. X passed rapidly southward from Dakota and Minnesota to the Missouri, and thence eastward until, on the 27th, 7:35 a. m., it was central in Illinois and Michigan. It was reinforced during this afternoon by an additional flow of air from the north, and continued increasing in extent and intensity as it moved eastward. December 28th, 7:35 a. m., it was central over Maine, with pressure 0.25 inches higher than in Illinois the previous morning. As usual, the air now began to flow with greater freedom southward over the Atlantic, and there was inaugurated a long series of foggy and rainy days along the East and Middle Atlantic coast, which, beginning with northeast winds and clear weather on the evening of the 27th, continued with fog, &c., until cleared away by the westerly winds on January 2nd. During this time the central high moved to the southeast of the Gulf of St. Lawrence, and the central low barometer, No. I of January, advanced to the Lake region, while the winds on the Atlantic coast veered from northeast to southwest and subsequently to west.